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Revision of the North American species of *Encalypta*

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(WITH PLATES, 13 AND 14)

The family Encalyptaceae, of which there is only one genus, *Encalypta*, is closely related to the Pottiaceae, because of the twisted and crisped habit of its leaves when dry, the small, thick-walled, very papillose cells of the upper portion of the leaves, and the large hyaline cells at the base. The costa also is strong and often excurrent. The genus is noted for the great diversity in the structure of its peristome, ranging from double, with several remarkable variations, to single or absent.

Hedwig (4, p. 88), in 1782, based the genus *Leersia* on two species, *Bryum pulvinatum* and *B. extinctorium*, referring the latter to its Linnean synonym (see p. 103 in the descriptions of figures 19 and 24). Of these two species *Bryum pulvinatum*, which is a *Grimmia*, precedes *B. extinctorium*; and since *Grimmia*, according to Ehrhart (6, p. 176), antedates *Leersia* by one year, the name *Leersia* has been discarded. Hence, the adoption of the name *Encalypta* Schreb., 1791 (9, p. 759), instead of *Leersia* Hedw., 1782, is due to the fact that *Leersia*, which in reality antedates *Encalypta*, was originally used by Hedwig to include *Grimmia*. Subsequently Hedwig, in 1801 (12, pp. 60-63), accepted the name *Encalypta* in place of *Leersia*.

Following the older authors, Lesquereux and James (32, pp. 180-184) placed *Encalypta* under the Orthotrichaceae, and Schim-

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per (28, pp. 307-340) with the Grimmiaceae; Lindberg (30, p. 26) and Braithwaite (33, pp. 279-287) adopted *Leersia* for *Encalypta*, referring it, as a subfamily, to the Tortulaceae, because of the leaf-characteristics. Limpricht (32, pp. 102-123) and Dixon (40, pp. 227-231) agree in recognizing the Encalyptaceae as distinct from the Pottiaceae, but Dixon places it under the subgroup Aplolepideae and Limpricht uses the terms Haplolepideae and Diplolepideae only in the specific descriptions. Loeske (48, p. 100) rejects Lindberg's usage of *Leersia* under the Tortulaceae and also the placing by Brotherus (44, pp. 436-439) of the Encalyptae as a subfamily of the Pottiaceae, and agrees with Fleischer (46, p. xiii), who places them under a new group, the Heterolepideae, because the peristome varies from the Haplolepideae to the Diplolepideae, stating that they should be treated as a separate family.

In 1904 Paris Index (45, pp. 119-126) listed 30 species, of which 18 were recorded for North America. According to Brotherus, in 1902 (44, pp. 436-439), there were 35 species, of which 21 were recorded for the whole of America, 14 being endemic and 18 occurring north of Mexico. We* have reduced this number to 8 by careful comparison of original and authentic specimens and by studying the types whenever possible, having seen type specimens of *E. longipes*, *E. Macounii*, and *E. Selwyni* from the Austin and Mitten Herbaria, and authentic material of *E. alaskana*, *E. leiocarpa*, *E. subspathulata*, *E. cucullata*, *E. subbrevicolla*, and *E. labradorica* from the Macoun collections. The accompanying lists and synonymy show the changes that have been made. Only one species remains doubtful, *E. lacera*, Ren. & Card. (38, p. 91); it was described in a footnote to their check list of North American mosses from specimens collected in Oregon by L. F. Henderson, and no specimens have been obtainable.

Chronological list of the North American species of Encalypta†

1753. *E. extinctoria* (L.) Sw. Disp. Musc. Suec. 24. 1799.
 1782. *E. laciniata* (Hedw.) Lindb. Acta Soc. Sci. Fenn. 10: 267.
 1872.
 1788. *E. contorta* (Wulf.) Lindb. Oefv. K. Vet. Akad. Foerh.
 20: 396. 1863.

* The responsibility for these reductions rests largely with Mrs. Britton.

† Adapted from Brotherus (44) and Paris Index (45).

1805. *E. alpina* Smith; Sowerby, Engl. Bot. *pl.* 1419. 1805.
 1811. *E. rhabdocarpa* Schwaegr. Suppl. 1: 56. *pl.* 16. 1811.
 1827. *E. apophysata* Nees & Hornsch. Bryol. Germ. 2: 49. *pl.* 15, f. 5. 1827.
 1832. *E. procera* Bruch, Abh. Akad. Münch. 1: 283. *pl.* 11. 1832.
 1849. *E. mexicana* C. Müll. Syn. 1: 516. 1849.
 1865. *E. longipes* Mitt. Jour. Linn. Soc. 8: 29. *pl.* 5. 1865.
 1877. *E. Macouni* Aust. Bot. Gaz. 2: 97. 1877.
 1877. *E. Selwyni* Aust. Bot. Gaz. 2: 109. 1877.
 1889. *E. leiocarpa* Kindb. Bull. Torrey Club 17: 275. 1889.
 1892. *E. subspathulata* C. Müll. & Kindb.; Macoun, Cat. Can. Pl. 6: 93. 1892.
 1892. *E. leiomitra* (Kindb.) Kindb.; Macoun, Cat. Can. Pl. 6: 94. 1892.
 1892. *E. cucullata* C. Müll. & Kindb.; Macoun, Cat. Can. Pl. 6: 96. 1892.
 1892. *E. alaskana* Kindb.; Macoun, Cat. Can. Pl. 6: 269. 1892.
 1892. *E. lacera* Ren. & Card. Rev. Bryol. 19: 91. 1892.
 1897. *E. subbrevicolla* Kindb. Eur. & N. Am. Bryin. 2: 295. 1897.
 1897. *E. labradorica* Kindb. Eur. & N. Am. Bryin. 2: 295. 1897.

Arrangement of the North American species of Encalypta*

§ 1. PYROMITRIUM (Wallr.) Kindb.

1. *E. alpina* Smith (*E. commutata* Nees & Hornsch.).

§ 2. XANTHOPUS Kindb.

2. *E. ciliata* (Hedw.) Hoffm. = *E. laciniata* (Hedw.) Lindb.
 3. *E. Macounii* Aust. = *E. apophysata* Nees & Hornsch.
 4. *E. alaskana* Kindb. = *E. laciniata*.

§ 3. RHABDOTHECA Kindb.

5. *E. vulgaris* (Hedw.) Hoffm. = *E. extinctoria* (L.) Sw.
 6. *E. rhabdocarpa* Schwaegr. (including *E. leiomitra* Kindb.).
 7. *E. lacera* Ren. & Card. = *E. rhabdocarpa*?
 8. *E. subspathulata* C. Müll. & Kindb. = *E. rhabdocarpa*.
 9. *E. mexicana* C. Müll. = *E. laciniata*.

* Adapted from Kindberg (42, pp. 292-297) and Brotherus (44, pp. 436-439).

§ 4. DIPLOLEPIS Kindb.

- 10. *E. longipes* Mitt. = *E. procera*.
- 11. *E. leiocarpa* Kindb. = *E. apophysata*.
- 12. *E. subbrevicolla* Kindb. = *E. brevicolla* Bruch.
- 13. *E. labradorica* Kindb. = *E. extinctoria*.

§ 5. STREPTOTHECA Kindb.

- 14. *E. contorta* (Wulf.) Lindb. (*E. streptocarpa* Hedw.).
- 15. *E. cucullata* C. Müll. & Kindb. = *E. procera* + *E. extinctoria*.
- 16. *E. procera* Bruch.
- 17. *E. Selwyni* Aust. = *E. procera*.

ENCALYPTA Schreb. Genera 2: 759. 1791

Leersia Hedw. Fundam. 2: 88, in part. 1782

Plants growing in dense compact cushions or mixed with other cespitose mosses; stems usually low and crowded, seldom more than 4 cm. high; branches usually simple and sub-apical, erect, the leaves uniformly spaced; leaves usually curled and twisted when dry, spreading above when moist, from an erect clasping oblong base, seldom more than 6 mm. long by 1.5 mm. broad; costa stout, either ending below the apex or excurrent into a subulate or mucronate point, cross-section of costa usually papillose above on both faces, with a large dorsal band of stereid cells and several upper layers of large ducts in 3-4 rows, the upper epidermal cells with thick walls and smaller papillae; cells of the upper part of the leaf-blade deeper than wide with clusters of prominent, minute papillae, those of the lower part of blade larger, oblong and usually without papillae, except in one species (*E. apophysata*) which has them on the short end walls; margins entire, flat or slightly recurved, rarely undulate. Perichaetial leaves generally smaller, more acuminate and often subulate.

Monoicous, or in one exception (*E. contorta*) dioicous; sometimes sterile and frequently propagating by elongated septate brood-bodies; the antheridia in small lateral axillary buds; archegonia terminal, vaginule enlarged, cylindric and often ochreate; seta usually elongate, smooth except in *E. streptocarpa*, seldom more than 1-2 cm., rarely 3 cm., long (*E. longipes*), usually twisted; calyptra large, 0.5-1 cm., completely covering the capsule to the base, cylindric and glossy, smooth or papillose at apex, sometimes slightly papillose over the entire surface, ragged or fringed at base; lid (operculum) large, never equalling the urn (theca), long-

rostrate; peristome originating at or below the mouth; simple (haplolepideous) or compound (diplolepideous), sometimes lacking; preperistome sometimes present; annulus simple or compound; teeth varying in length, usually papillose or striate, entire or split along the median line, rarely more or less united and attached to the endostome by a hyaline membrane, sometimes nodose or with short intermediate cilia; walls of the urn (theca) either smooth or striate, striae sometimes visible only after sporosis, sometimes spirally twisted or deeply grooved; neck (column) short, stomatose, or the stomata scattered along the wall; spores smooth or rough, usually maturing in spring or summer, variable in size.

Type species, *Bryum extincitorium* L.

The genus divides itself naturally into two groups or sections:

§ 1. *Haplolepideae*, with the peristome single or absent, and § 2. *Diplolepideae*, with the peristome double and variable.

In § 1 are included 4 species that are found in Europe and North America: *E. alpina*, *E. extincoria*, *E. laciniata*, and *E. rhabdocarpa*, the last two approaching the *Diplolepideae* by having a preperistome.

In § 2 are included 4 species, also common to Europe and North America: *E. apophysata*, *E. brevicolla*, *E. procera*, and *E. contorta*; of these *E. contorta* has not yet been found fruiting on this continent.

Key to species

- § 1. HAPLOLEPIDEAE. Peristome simple or lacking; teeth, when present, short, lanceolate; capsule not twisted.
Capsule striate, or becoming so when old.
Calyptra lacerate at base, nearly smooth at apex.
Peristome only occasionally found. Walls of cells at base of leaves thickened. 1. *E. extincoria*.
Peristome usually present, often with preperistome.
Walls of cells at base of leaves not thickened. 2. *E. rhabdocarpa*.
Capsule smooth.
Calyptra lacerate at base but not fringed. Peristome never present, spores papillose. 3. *E. alpina*.
Calyptra with a persistent or fugacious fringe of larger cells. Peristome usually present, deeply inserted. 4. *E. laciniata*.
§ 2. DIPLOLEPIDEAE. Peristome double, teeth usually long and slender; endostome more or less adherent to the teeth.
Capsule smooth, calyptra fringed or lacerate.
Teeth perforate or split along median line. Basal cells of leaves with short walls papillose. 5. *E. apophysata*.

Teeth more or less united in pairs, unequal in length.

Basal cells of leaves not papillose.

6. *E. brevicolla*.

Capsule striate and spirally twisted, calyptra lacerate.

Monoicous, seta smooth, spores 15–25 μ ; leaves slightly toothed at base.

7. *E. procera*.

Dioicous, seta slightly papillose, spores 8–12 μ , leaves entire.

8. *E. contorta*.

§ 1. Haplolepideae

1. ENCALYPTA EXTINGTORIA (L.) Sw. Disp.⁵ Musc. Suec. 24. 1799

Bryum extingtorium L. Sp. Pl. 1116. 1753.

Leersia extingtoria Hedw. Fundam. 2: 88. 1782.

Leersia marginata Hedw. Fundam. 2: 103. 1782.

Leersia vulgaris Hedw. Descr. 1: 46. 1787.

Encalypta vulgaris Hoffm. Deuts. Fl. 2: 27. 1796.

Encalypta cucullata C. Müll. & Kindb.; Macoun, Cat. Can. Pl. 6: 96, in part. 1892.

Encalypta extingtoria subsp. *tenella* Kindb.; Röhl, Hedwigia 35: 65. 1896.

Plants small, about 0.5–1 cm. high; leaves up to 4 mm. long, 1 mm. wide; apical blade lingulate, apex cucullate contracted to an abrupt point; costa ending below the apex, smooth on both faces except slightly toothed at tip on back; margins plane, erose above; papillose cells 12–14 μ long; cells of hyaline base oblong, up to 55 μ long by 15 μ wide, walls brown, slightly thickened at ends, with 7–8 rows of long narrow cells at margin; perichaetial leaves shorter and blunt at apex, usually carinate when moist. Monoicous; vaginule about 1.5 mm. long; seta 5–8 mm., red brown, not twisted; calyptra entire or ragged at base, slightly papillose at apex; lid about 1.5 mm. long; capsule 2–3 mm. long by 1 mm. wide, cylindric, smooth when young, ribbed when old; annulus simple, narrow; mouth marked by an irregular, broken row of 1–2 quadrate, small, thickened cells; urn with the stomata sparsely scattered over the entire surface; neck short, red, without stomata; peristome, when present, of simple fugacious teeth; spores rough with large rounded papillae, 24–32 μ , maturing in early spring.

TYPE LOCALITY: European.

DISTRIBUTION: On rocks and earth in the Rocky Mountains, from British Columbia to Colorado, and South Dakota; western states from Nevada to California. Also Eurasia and Australasia, according to Paris Index (45).

ILLUSTRATIONS: Dill. Hist. Musc. pl. 45. f. 8. 1741 (as *Bryum*); Hedw. Descr. 1: pl. 18. 1787 (as *Leersia*); Bryol. Eur. pl. 199. 1838 (as *E. vulgaris*).

EXSICCATAE: Macoun, Can. Musci 491 (as *E. cucullata*); Holz. Musci Acro. Bor. Am. 214. 1906.

1a. ENCALYPTA EXTINCTORIA APICULATA Wahl. Fl. Lapp. 344. 1812

Costa usually excurrent into a short hair-point; capsule when mature striate and somewhat ribbed.

DISTRIBUTION: Colorado, Montana, and Assiniboia. Also Europe.

1b. ENCALYPTA EXTINCTORIA MUTICA Brid. Musc. Recent. Suppl. 4: 28. 1819

Costa disappearing far below the blunt apex; mature capsule ribbed.

DISTRIBUTION: Colorado to British Columbia. Also Europe.

2. ENCALYPTA RHABDOCARPA Schwaegr. Suppl. 1: 56. 1811

Leersia rhabdocarpa Lindb. Musci Scand. 26. 1879.

Encalypta rhabdocarpa var. *leiomitra* Kindb. Ottawa Nat. 4: 61. 1890.

Encalypta subspathulata C. Müll. & Kindb.; Macoun, Cat. Can. Pl. 6: 93. 1892.

Encalypta leiomitra Kindb.; Macoun, Cat. Can. Pl. 6: 94. 1892.

Plants 1.5–2 cm. high; leaves 3–4 mm. by 0.66–1 mm. wide, lingulate, flat and spreading when moist; costa extending beyond the suddenly contracted apex of leaf into a long mucronate hair-point or ending below the apex, papillose on back below the middle and on the upper surface above the middle of the leaf; margin plane; papillose cells, hexagonal, diameter 15–20 μ ; cells of hyaline base, irregular, not papillose, 24–48 μ long by 24 μ wide; walls orange, not thickened, with a distinct marginal border of 6–8 rows of cells, 60 μ long by 6–10 μ wide; perichaetial leaves smaller and tapering to a hair-point. Monoicous; seta 6–8 mm., orange, not twisted; calyptra entire or ragged at base, papillose at apex and sometimes to about the middle; lid about 2 mm.; capsule 2–3 mm. long by 1 mm. wide, cylindric, striate, each ridge of about 5–6 rows of cells; annulus simple; rim of the mouth marked by 2–3 rows of small brown quadrate cells; stomata numerous, scattered throughout the entire surface of the urn; neck short, red, deeply wrinkled with large loose cells; peristome usually present, single, of 16 red, finely striate, papillose teeth, with 4–5 segments, and occasionally with a narrow lateral preperistome covering 1–2 segments at base of the teeth; spores 40–50 μ in diameter, very rough with large granular warts, ripe in late spring.

According to Limpricht (39, p. 115. *f.* 245, 246) there is great variation in the peristomes of this species. However, we have not found any peristome to correspond with his *f.* 246 in American specimens.

TYPE LOCALITY: European.

DISTRIBUTION: Arctic America, Greenland, Labrador to Quebec and northern New York, Rocky Mountains from Montana to New Mexico, Pacific Coast ranges from Washington to California. Also Europe and Asia.

ILLUSTRATIONS: Schwaegr. Suppl. 1: *pl.* 16. 1811; Bryol. Eur. *pl.* 205. 1838.

EXSICCATAE: Drummond, Musci Am. 50, 51 in part; also 52. 1828. Sull. & Lesq. Musci Bor. Am. 112. 1856; ed. 2. 166. 1865; Macoun, Can. Musci 131, 421 (as *E. subspathulata*).

E. leiomitra differs from *E. rhabdocarpa* only in that the apex of the calyptra is nearly smooth.

E. subspathulata is undoubtedly *E. rhabdocarpa*, but all of the older capsules are badly infected by fungi and filled with hyphae.

2a. ENCALYPTA RHABDOCARPA PILIFERA (Funck) Nees & Hornsch.
Bryol. Germ. 2: 41. 1827

Encalypta pilifera Funck, in Sturm, Deuts. Fl. 17: *pl.* 5. 1819.

Leersia extintoria var. *pilifera* Lindb. Musc. Scand. 20. 1879.

Leaves somewhat broader and more ovate; costa excurrent into a long toothed hair; peristome perfect.

DISTRIBUTION: Fraser River Valley, Canada. Also Europe.

ILLUSTRATION: Sturm, Deuts. Fl. 17: *pl.* 5.

2b. ENCALYPTA RHABDOCARPA MICROSTOMA Breidler; Limpr.
Laubm. 2: 115. 1895

Capsule narrowing to a small mouth. Lid small, extended into a long point; peristome perfect or rudimentary. A parallel form to *E. laciniata microstoma*.

DISTRIBUTION: Alpine regions of the Rocky Mountains. Also Europe.

3. ENCALYPTA ALPINA Smith; Sowerby, Engl. Bot. *pl.* 1419. 1 F
1805

Encalypta affinis Hedw. f. Weber & Mohr's Beitr. 1: 121. Mr 1805.

Encalypta commutata Nees & Hornsch. Bryol. Germ. 2: 46. 1827.
Leersia alpina Lindb. Musci Scand. 20. 1879.

Plants 4-6 cm. high; leaves 3-4 mm. by 1 mm. subspatulate, carinate; apex cucullate when moist; costa excurrent into a long hair-point or ending below the apex, smooth except for a few teeth just below the apex of leaf; margin plane; upper cells hexagonal, 12μ - 16μ , not densely papillose; cells of hyaline base 32μ - 48μ long by 16μ wide, walls not thickened, becoming narrower and longer toward the margin; perichaetial leaves smaller and tapering to a long hair point. Monoicous; vaginule about 1 mm. long; seta 7-9 mm. long, orange, seldom twisted; calyptra laciniate at base, very slightly papillose at apex; lid 1.5 mm. long; annulus of 2-3 rows of cells; capsule 2-3 mm. long by 0.75 mm. wide, cylindric, smooth when young, appearing striate when old; mouth marked by 1-2 rows of small red-brown quadrate cells often irregularly broken; neck short, wrinkled, stomatose; peristome none; spores 25μ - 35μ , warty, often flattened and irregular, ripe in late summer.

TYPE LOCALITY: European.

DISTRIBUTION: Alpine regions of the Rocky Mountains from Colorado to Washington; Alaska and Greenland. Also Europe and Asia.

ILLUSTRATIONS: Sowerby, Engl. Bot. pl. 1419. 1805; Weber & Mohr's Beitr. 1: pl. 4. 1805; Schwaegr. Suppl. 1: pl. 16. 1811 (as *E. affinis*); Bryol. Eur. pl. 198. 1838.

EXSICCATAE: Drummond, Musci Am. 49. 1828 (as *E. affinis*).

4. ENCALYPTA LACINIATA (Hedw.) Lindb. Acta Soc. Sc. Fenn. 10: 267. 1872

Bryum extincitorium var. β . L. Sp. Pl. 1116. 1753 (see Dillen, 1, p. 349; also Druce & Vines, 47, p. 210).

Leersia laciniata Hedw. Fundam. 2: 103. pl. 5, f. 24a. 1782.

Leersia ciliata Hedw. Descr. 1: 49. 1787.

Encalypta ciliata Hoffm. Deuts. Fl. 2: 27. 1796.

Encalypta mexicana C. Müll. Syn. 1: 516. 1849.

Encalypta alaskana Kindb.; Macoun, Cat. Can. Pl. 6: 269. 1892.

Plants growing on wet limestone rocks; about 1-3 cm. high; leaves carinate when moist, up to 5 mm. long, to about 1.3 mm. wide; apical blade elliptic or lingulate, suddenly contracted to a short mucronate point; costa thick, tapering into the short finely serrulate tip or ending below the apex, slightly toothed on

the back; margins revolute below the middle, above entire or erose with truncate, minutely papillose cells up to $13\text{--}24\mu$ in diameter; cells of the hyaline base not papillose, oblong, up to 60μ long by $13\text{--}21\mu$ wide, becoming narrower toward the margin, the basal cells with brown walls; perichæatial leaves slightly smaller. Monoicous; seta yellow to brown, 5–10 mm. high; calyptra broadening at base into a deep regular fringe of larger cells, smooth or slightly roughened at apex; lid beaked, up to 2 mm. long; annulus present, of one row of cuneate cells; capsule 3–5 mm. long by 1 mm. wide, cylindric, smooth; mouth narrow bordered by 3–5 rows of smaller thickened cells; urn with numerous large stomata from the middle to the neck; peristome deeply inserted, single; teeth lanceolate with 5–7 joints, which are longitudinally papillose inside and occasionally with a darker colored preperistome partially covering the basal segments; spores up to 37μ in diameter, with radiating stellate lines, maturing in summer.

TYPE LOCALITY: European.

DISTRIBUTION: Alpine and mountain regions; Eastern States from Maine to northern New York; North Central States from Michigan to Wisconsin, Minnesota; Rocky Mountains from Montana to New Mexico; west coast from Washington to California; British America from Ontario to British Columbia. Also Europe, Asia, Africa and Australia.

ILLUSTRATIONS: Dill. Hist. Musc. *pl.* 45. *f.* 9. 1741; Hedw, Descr. 1. *pl.* 19. 1787; Bryol. Eur. *pl.* 200. 1838.

EXSICCATAE: Drummond. Musci Am. 50. 1828; Sull. & Lesq. Musci Bor. Am. 111. 1856; ed. 2. 165. 1865; Austin, Musci Ap. 174. 1870; Macoun, Can. Musci 132 (as *E. ciliata*), and 133 (as *E. Macounii*); Allen, Mosses of Cascade Mts. Wash. 45; Holz. Musci Acro. Bor. Am. 213. 1906; Pringle, Plantae Mexicanæ 10547 (as *E. mexicana*).

4a. ***Encalypta laciniata microstoma*** (Schimp.) comb. nov.

Encalypta ciliata var. *microstoma* Schimp. Coroll. Bryol. Eur. 38. 1855.

Seta only 3–6 mm. high; calyptra with brown fringe; capsule narrowing to a small mouth. Neck somewhat longer and running down into the seta; peristome smaller, irregular, often lacking; spores very finely papillose, less transparent, and the radiating lines less distinct; ripe in August.

DISTRIBUTION: Northern New York and in the alpine regions of the Rocky Mountains. Also Europe and Asia.

Diplolepideae

5. ENCALYPTA APOPHYSATA Nees & Hornsch. Bryol. Germ. 2: 49. 1827

Encalypta Macounii Aust. Bot. Gaz. 2: 97. 1877.

Encalypta leiocarpa Kindb. Bull. Torrey Club 17: 273. 1890.

Plants 1.5–2 cm. high; leaves 3–4 mm. long by 1 mm. wide, carinate, lingulate; costa ending in the blunt apex or rarely excurrent into a short mucronate point, densely papillose on both surfaces with coarse spinose teeth on dorsal apex; margins revolute above; cells of upper blade 8–10 μ , irregular, those of the hyaline base 50–60 μ long by 8–10 μ wide with the end walls thickened, with papillose projections; perichaetial leaves slightly broader. Monoicous. Seta 10–12 mm. long, smooth; calyptra 6–7 mm. long by 1 mm. wide, very scabrous at apex, papillose over the entire surface, basal fringe sometimes fugacious, cells of fringe narrow; lid about 2 mm. high; capsule 2–3 mm. long by 0.5 mm. wide, not striate, neck apophysate when dry or when wet long and tapering; annulus of 2–3 rows of cells, more or less persistent; mouth bordered by 3–4 rows of small thick-walled hexagonal cells; peristome obscurely double; teeth slender, very papillose, perforate, rarely bifid, inner peristome white, papillose, adhering closely and almost invisibly to the outer; spores 18–24 μ , finely papillose, maturing in summer.

TYPE LOCALITY: European.

DISTRIBUTION: Rocky Mountains of British Columbia to Montana; and (according to Paris Index) Scoresby Straits, Arctic America. Also Europe and Asia.

ILLUSTRATIONS: Bryol. Eur. *pl.* 201. 1838; Limpricht, Laubm. 2: *f.* 247. 1891.

EXSICCATAE: None. Drummond, Musci Am. 50, is *E. laciniata*; so are many of the specimens cited in Macoun's Catalogue (37) for *E. Macounii*. The American specimens of this species seem to have the leaves more often blunt than is usual in the European ones, though Limpricht (39) describes them as *obtusae* or *short-pointed*. The type specimens of *E. Macounii* in Austin's herbarium are immature and no spores were formed, but in all other characters they agree with *E. apophysata*. The description of *E. leiocarpa* is erroneous in two important characters, for the calyptra is fringed and the peristome is double.

6. ENCALYPTA BREVICOLLA (B. S. G.) Bruch; C. Müll. Syn.

1: 519. 1849

Encalypta longicolla var. *brevicolla* B. S. G. Bryol. Eur. (4:)

Encalypta 12. 1838.

Encalypta labradorica Kindb. Eur. & N. Am. Bryin. 2: 295. 1897.*Encalypta subbrevicolla* Kindb. Eur. & N. Am. Bryin 2: 295. 1897.

Plants 1–1.5 cm. high; leaves 4–5 mm. long by 1 mm. wide, subacuminate, carinate; costa excurrent into long colorless hair-point, sometimes toothed at the base of awn, papillose on both surfaces; margins plane; upper cells of blade 12–16 μ in diameter, irregular; those at the hyaline base 40–48 μ long by about 16 μ wide, becoming narrower and colorless at the smooth margins; walls orange-colored, slightly thickened at ends; perichaetial leaves slightly shorter and broader. Monoicous; seta 1 cm. long, smooth, red; calyptra 5 mm. long by 1 mm. wide, very scabrous at the apex, papillose over the entire surface, lacerate at base; lid 2–2.25 mm. high, with a red border; capsule about 3 mm. long by 1 mm. wide, not striate; neck short, stomatose, with large basal cells; annulus none; mouth bordered by 4–5 rows of small, thick-walled, quadrate cells; peristome double, deeply inserted; teeth .8 mm. high, irregularly broken and branched, usually united in pairs at base and perforate above, papillose; inner peristome similar and attached to the outer, median segments longer than the lateral ones; spores 28–32 μ , very rough.

TYPE LOCALITY: European.

DISTRIBUTION: Labrador and, according to Paris Index, the eastern coast of Greenland. Also Europe.

ILLUSTRATIONS: Bryol. Eur. *pl.* 202, β . 1838.

EXSICCATAE: None.

7. ENCALYPTA PROCERA Bruch, Abh. Akad. Münch. 1: 283. 1832

Encalypta longipes Mitt. Jour. Linn. Soc. 8: 29. 1865.*Encalypta Selwyni* Aust. Bot. Gaz. 2: 109. 1877.*Leersia procera* Lindb. Musci Scand. 20. 1879.*Leersia Selwyni* E. G. Britton, Bull. Torrey Club 18: 50. 1891.

Encalypta cucullata C. Müll. & Kindb.; Macoun, Cat. Can. Pl. 6: 96, in part. 1892.

Plants 2–4 cm. high; leaves more or less spreading when dry, 5–6 mm. long by 1 mm. wide; apical blade subspathulate, apex blunt; costa ending below apex, papillose on upper surface, scabrous on back; margin revolute above; upper cells 12–16 μ in diameter, round; those of the hyaline base, 48–60 μ long by 12–16 μ wide;

walls deep orange, thickened at ends, basal margin slightly serrate; with 3-4 rows of narrow cells, walls colorless and ends unthickened; perichaetial leaves acuminate, tapering, with the costa percurrent into a long hair-point. Monoicous; seta about 1.5-2 cm., smooth, purple shading to orange above; calyptra 6-7 mm. long by 1.5 mm. wide, papillose at apex, very slightly so over the entire surface, lacerate at base but without differentiation of cells; lid 2 mm., marked by ragged broken cells at base; capsule 3-4 mm. long by 0.4 mm. wide, cylindric, slightly striate when young, marked when old by 8 striae, spirally twisted once or twice around the capsule; annulus large, compound; mouth bordered by 2 rows of small thick-walled quadrate cells; neck short, stomatose; peristome double, teeth about 0.5 mm. long, narrow, red, smooth or papillose, basal segments of teeth united and perforated; endostome papillose, orange, as long as the teeth, attached to a papillose basal membrane, the segments alternating with short cilia; spores 15-25 μ , smooth, granular inside.

TYPE LOCALITY: European.

DISTRIBUTION: On earth in crevices of rocks and on banks; Ontario to British Columbia and Alaska; the Rocky Mountains of Idaho and Montana; Greenland. Also northern Europe and Asia.

ILLUSTRATIONS: Abh. Akad. Münch. 1: *pl.* 2. 1832; Bryol. Eur. *pl.* 205. 1838; Mitt. Jour. Linn. Soc. 8: *pl.* 5. 1865 (as *E. longipes*).

EXSICCATAE: Drummond, Musci Am. 48. 1828 (as *E. streptocarpa*); Macoun, Can. Musci 134 (as *E. Selwyni*), 474 (as *E. longipes*), 491 in part (as *E. cucullata*), and 565 (as *E. procera*).

8. ENCALYPTA CONTORTA (Wulf.) Lindb. Oefv. Sv. Vet.-Akad. Förh. 20: 396. 1863

Bryum contortum Wulf.; Jacq. Coll. 2: 236. 1788.

Encalypta streptocarpa Hedw. Sp. Musc. 62. 1801.

Leersia contorta Lindb. Musci Scand. 19. 1879.

Plants 2-4 cm. high; leaves spreading when dry, 5-6 mm. long by 1.5 mm. wide; apical blade lingulate, carinate; apex tapering to the blunt point; costa ending below the apex, very papillose on both surfaces, scabrous on back at basal portion; margins plane; upper cells 12-16 μ in diameter, round, those of the hyaline base, 40-48 μ long by 16 μ wide, not papillose; walls deep orange, slightly thickened at angles, basal margins bordered by 2-3 rows

of long narrow cells; perichaetial leaves 2–3 mm., more acuminate. Dioicous. Seta about 1.5–2 cm. long, slightly papillose, purple; calyptra 8–10 mm. long by 1 mm. wide, brown, lacerate at base, very rough at apex, entire surface slightly papillose; lid 1.5 mm. long; capsule 4–5 mm. by 2–3 mm. wide, larger at base, deeply grooved with 8 striae, which are spirally twisted 2–3 times around the capsule; annulus large, compound, persistent; mouth bordered by 2–3 rows of small thick-walled quadrate cells; neck short, stomatose, red; peristome double; teeth long, narrow, orange-colored, very papillose; endostome with 32 paler papillose segments, one half the length of teeth, united at base by a thin papillose membrane; spores 8–12 μ , smooth, irregular, ripe in early summer.

TYPE LOCALITY: European.

DISTRIBUTION: On limestone rock, sand and earth in temperate and alpine regions of Canada and Ontario to the Rocky Mountains; Eastern States from Vermont to Virginia; Central States from Ohio to Minnesota; Colorado and California, according to Paris Index. Also Europe and Asia. Fruit plentiful in Europe but not yet found in North America.

ILLUSTRATIONS: Hedw. Sp. Musc. *pl.* 10. 1801 (as *Encalypta streptocarpa*); Bryol. Eur. *pl.* 204. 1838.

EXSICCATAE: Sull. Musci Allegh. 152. 1845; Aust. Musci App. 175. 1870; Macoun, Can. Musci 135; Holz. Musci Acro. Bor. Am. 141. 1904.

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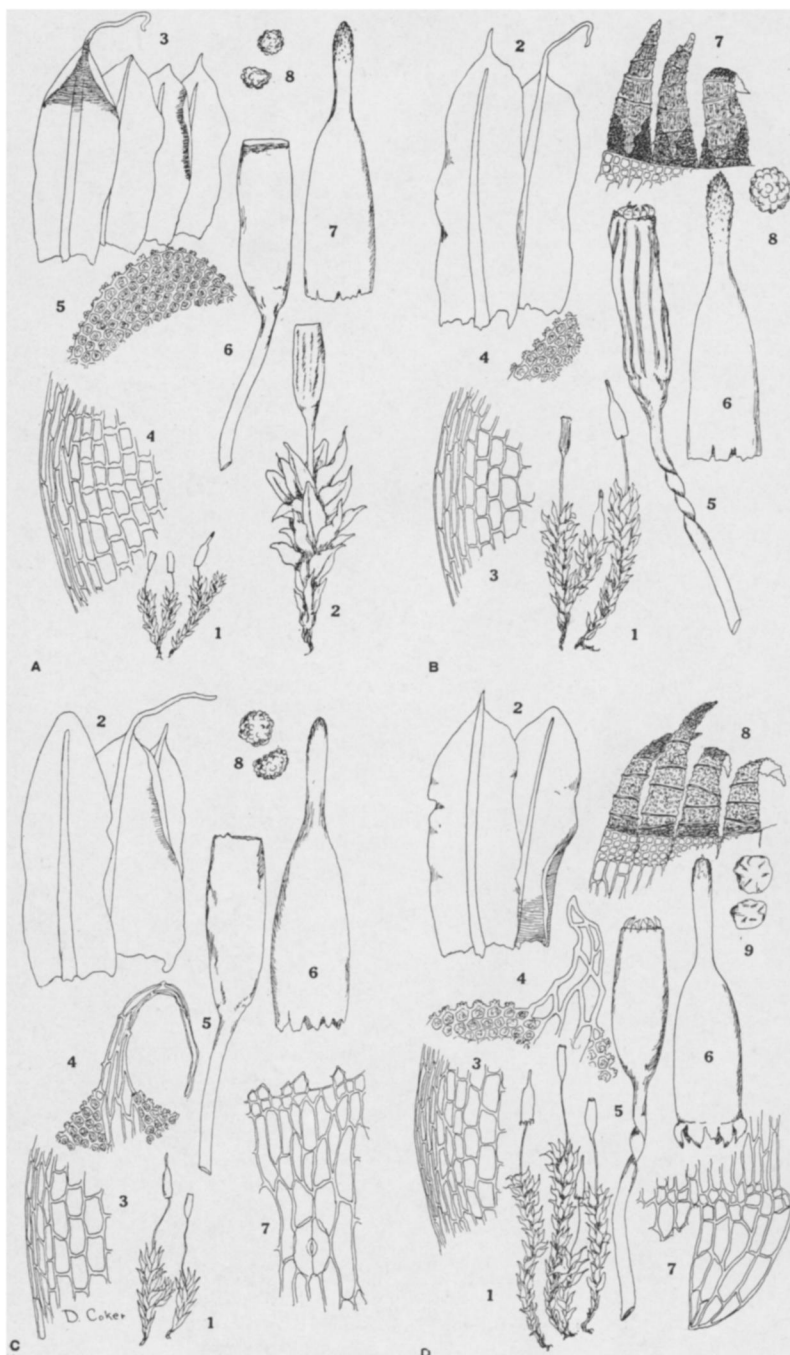
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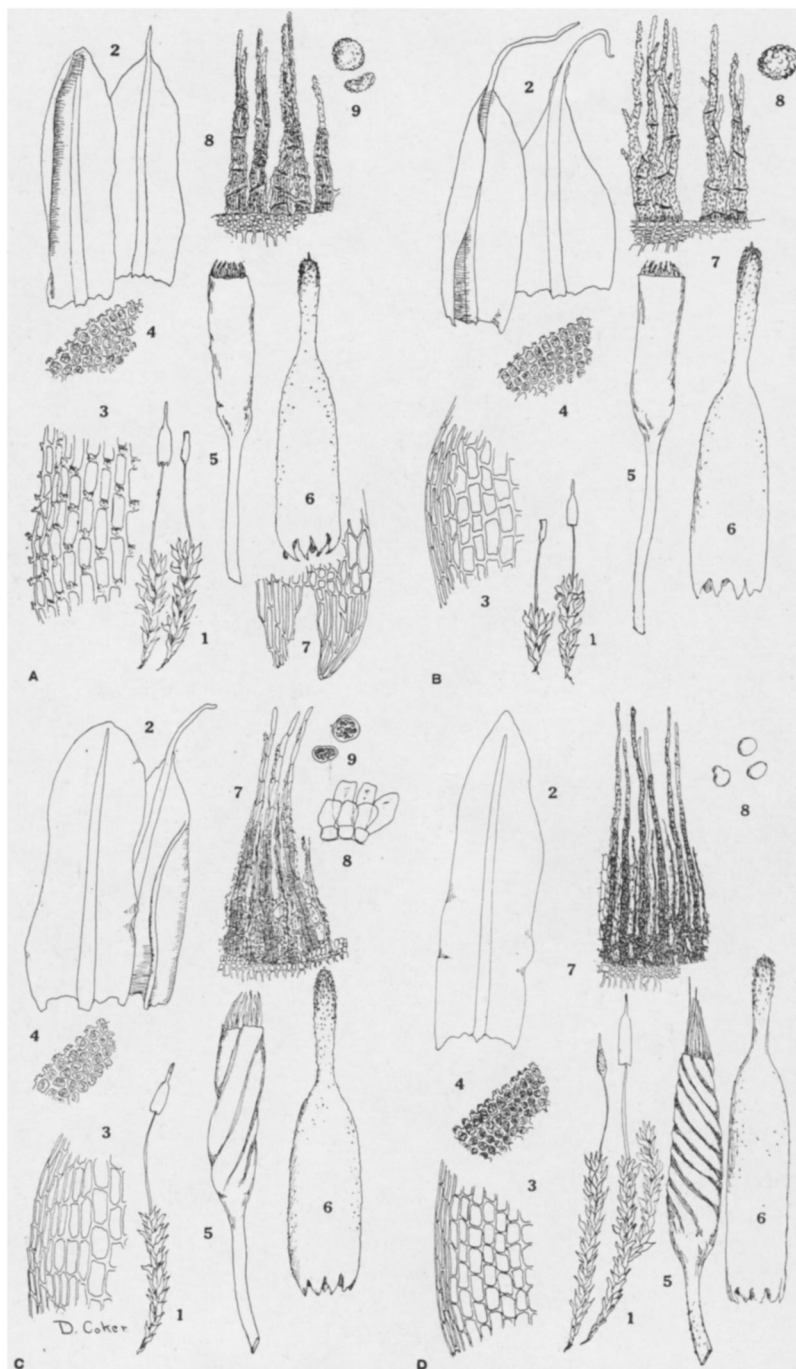
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A. *ENCALYPTA EXTINGTORIA* (L.) Sw.
 B. *ENCALYPTA RHABDOCARPA* SCHWAEGR.
 C. *ENCALYPTA ALPINA* SMITH
 D. *ENCALYPTA LACINIATA* (HEDW.) LINDB.

A. *ENCALYPTA APOPHYSATA* NEES & HORNSCH.B. *ENCALYPTA BREVICOLLA* BRUCHC. *ENCALYPTA PROCERA* BRUCHD. *ENCALYPTA CONTORTA* (WULF.) LINDB.

Description of plates 13 and 14

PLATE 13

A. *ENCALYPTA EXTINCTORIA* (L.) Sw. 1. Plant, natural size. 2. Single plant, enlarged. 3. Various forms of leaves. 4. Base of leaf showing hyaline cells with border. 5. Apex of leaf showing smaller papillose cells. 6. Capsule enlarged. 7. Calyptra with rough apex. 8. Rough spores.

B. *ENCALYPTA RHABDOCARPA* Schwaegr. 1. Plants, about natural size. 2. Forms of leaves. 3. Smooth basal cells. 4. Apical papillose cells. 5. Ribbed capsule. 6. Calyptra with rough apex. 7. Peristome showing basal preperistome. 8. Rough spores.

C. *ENCALYPTA ALPINA* Smith. 1. Plants, natural size. 2. Forms of leaves. 3. Basal cells. 4. Apex with subulate awn. 5. Capsule. 6. Calyptra. 7. Portion of capsule walls showing ragged rim of mouth and one stoma. 8. Rough spores.

D. *ENCALYPTA LACINIATA* (Hedw.) Lindb. 1. Plants, about natural size. 2. Leaves. 3. Basal cells and border. 4. Apex with mucronate point. 5. Capsule. 6. Fringed calyptra. 7. Basal portion enlarged. 8. Rough peristome, and rim of capsule. 9. Smooth, stellate spores.

PLATE 14

A. *ENCALYPTA APOPHYSATA* Nees & Hornsch. 1. Plants, natural size. 2. Leaves. 3. Basal cells, with papillose transverse walls. 4. Apical cells. 5. Capsule. 6. Papillose calyptra. 7. Base of same, fringed. 8. Double peristome, the inner more or less attached to the outer. 9. Rough spores.

B. *ENCALYPTA BREVICOLLA* Bruch. 1. Plants. 2. Leaves. 3. Cells of base. 4. Cells of apex. 5. Capsule. 6. Papillose calyptra. 7. Double papillose peristome, the inner more or less branched. 8. Rough spore.

C. *ENCALYPTA PROCERA* Bruch. 1. Plant. 2. Stem and perichaetial leaves. 3. Smooth basal cells. 4. Papillose apical cells. 5. Twisted capsule. 6. Papillose ragged calyptra. 7. Double peristome, the inner perforate at base. 8. Fragment of annulus. 9. Smooth spores.

D. *ENCALYPTA CONTORTA* (Wulf.) Lindb. 1. Plants. 2. Leaf. 3. Basal cells. 4. Apical cells. 5. Twisted capsule. 6. Papillose and ragged calyptra. 7. Double peristome more or less united with intermediate cilia. 8. Smooth spores.